Understand the Input Data Prior to Ambient Impact Modeling

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Current Practices in Input Data Selection

- Permit Limits
- AP-42 Emission Factors
- Source Measurement/Monitoring

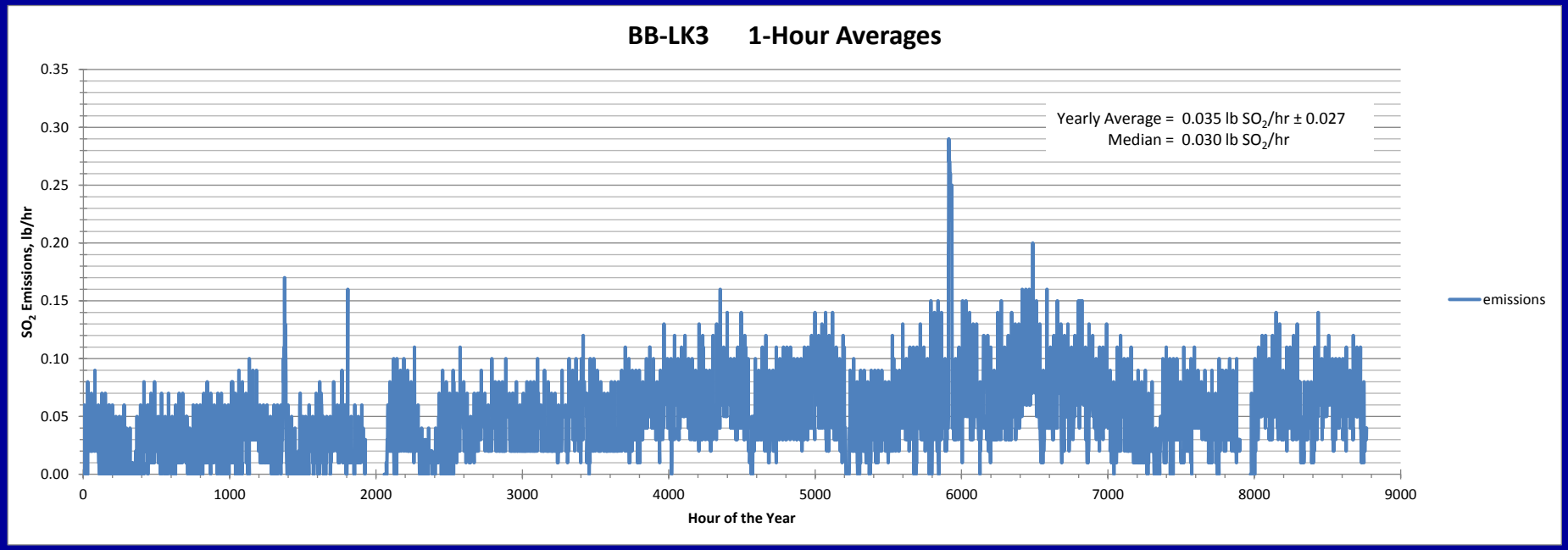
Three Questions Relative to Ambient Impact Modeling

1. Are permit limits appropriate representation of source emissions?
2. Do AP-42 emission factors/methods represent actual emissions?
3. Do EPA test methods always correctly measure the pollutants of interest?

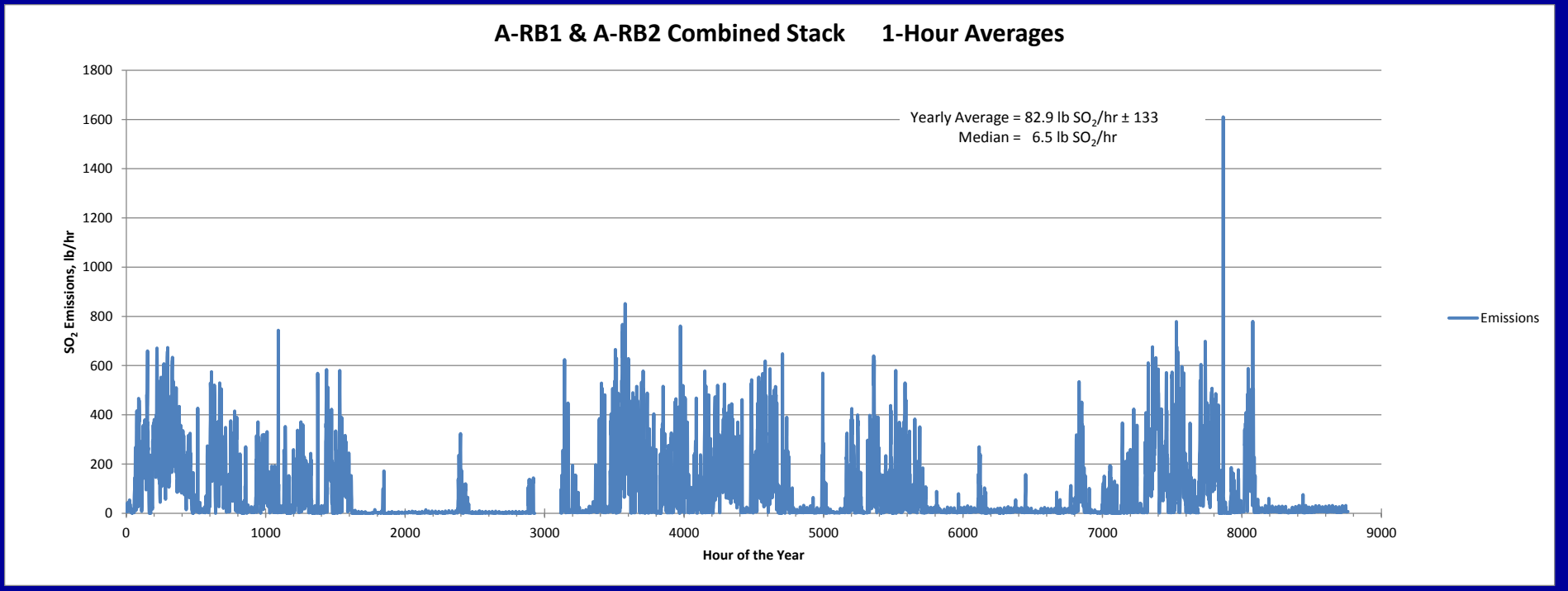
Question No. 1

Are permit limits appropriate representation of source emissions?

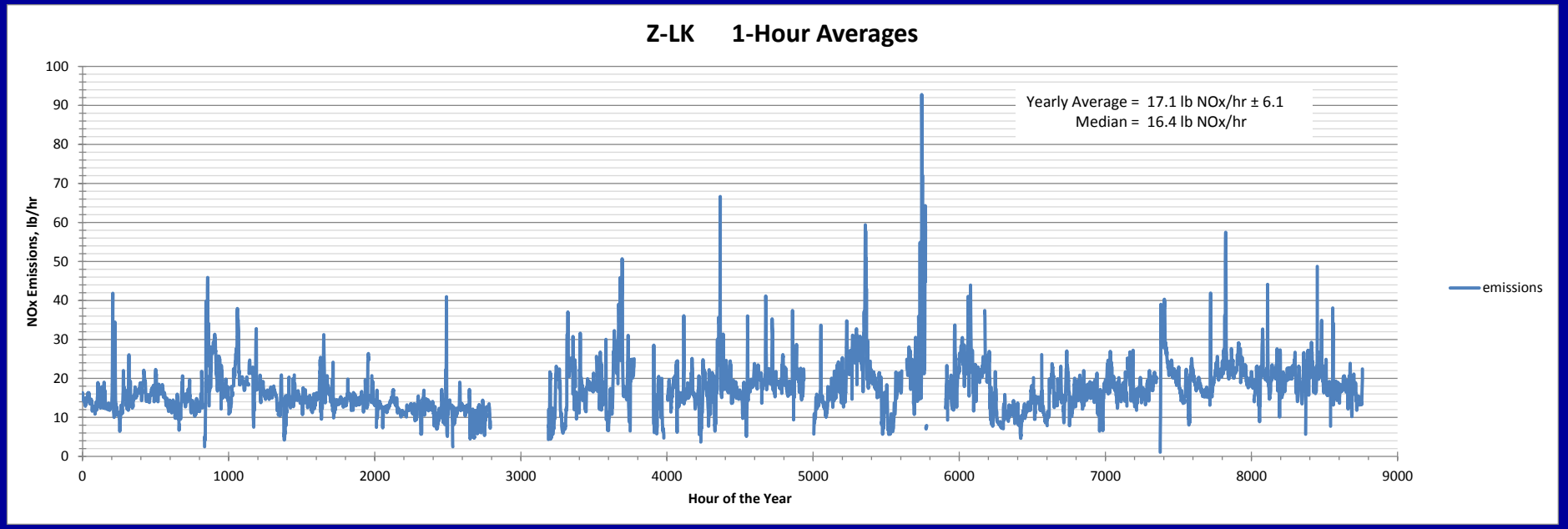
Source #1 lime kiln. Average hourly SO_2 emissions 0.035 lb/hr. Permit limit 153 lb/hr.



Source # 2 recovery furnace. Average hourly SO_2 emissions 82.9 lb/hr. Permit limit 806.6 lb/hr.



Source # 3 lime kiln. Average hourly NO_x emissions 17.1 lb/hr. Permit limit 64 lb/hr.



Question No. 2

Do AP-42 emission factors/methods represent actual emissions?

Storage Pile PM Emissions

- Emissions estimated by empirical methods
  - Based on test data for coal, sand or gravel
  - Estimates yield Total Suspended Particulate (TSP) emissions

$$EF_{PM10} = k_{PM10} EF_{TSP} \qquad EF_{PM2.5} = k_{PM2.5} EF_{TSP}$$

  - k_{PM10} and $k_{PM2.5}$ (portions of TSP attributed to size fractions) not available for wood or bark

Storage Pile PM Emissions

- Applicability to FPI sources not established
  - Higher particle density
  - Moisture range: ~0.5-5.0% & Silt range: 1-20%
  - No threshold friction velocity for wood or bark PM
  - AP-42 estimates for PM fractions

$$k_{PM\,10} = 0.35 \qquad k_{PM\,2.5} = 0.053$$

Storage Pile PM Emissions NCASI Work

- Preliminary work completed to characterize silt fractions for chip and bark and k_{PM10} and $k_{PM2.5}$

	5 Mill Test	AP-42
Chips	s = 0.00014% k_{PM10} = 0.0030 $k_{PM2.5}$ = 0.0005	s = None for wood or bark k_{PM10} = 0.35 $k_{PM2.5}$ = 0.053
Bark	s = 0.0013% k_{PM10} = 0.0015 $k_{PM2.5}$ = 0.0002	

Summary of Preliminary Results

- Use of AP-42 values would significantly overestimate emissions from these sources
- None of the $PM_{2.5}$ (from SEM analysis) attributed to woody or fibrous material

Question No. 3

Do EPA test methods always correctly measure the pollutants of interest?

Current EPA Methods for Measuring $PM_{2.5}$

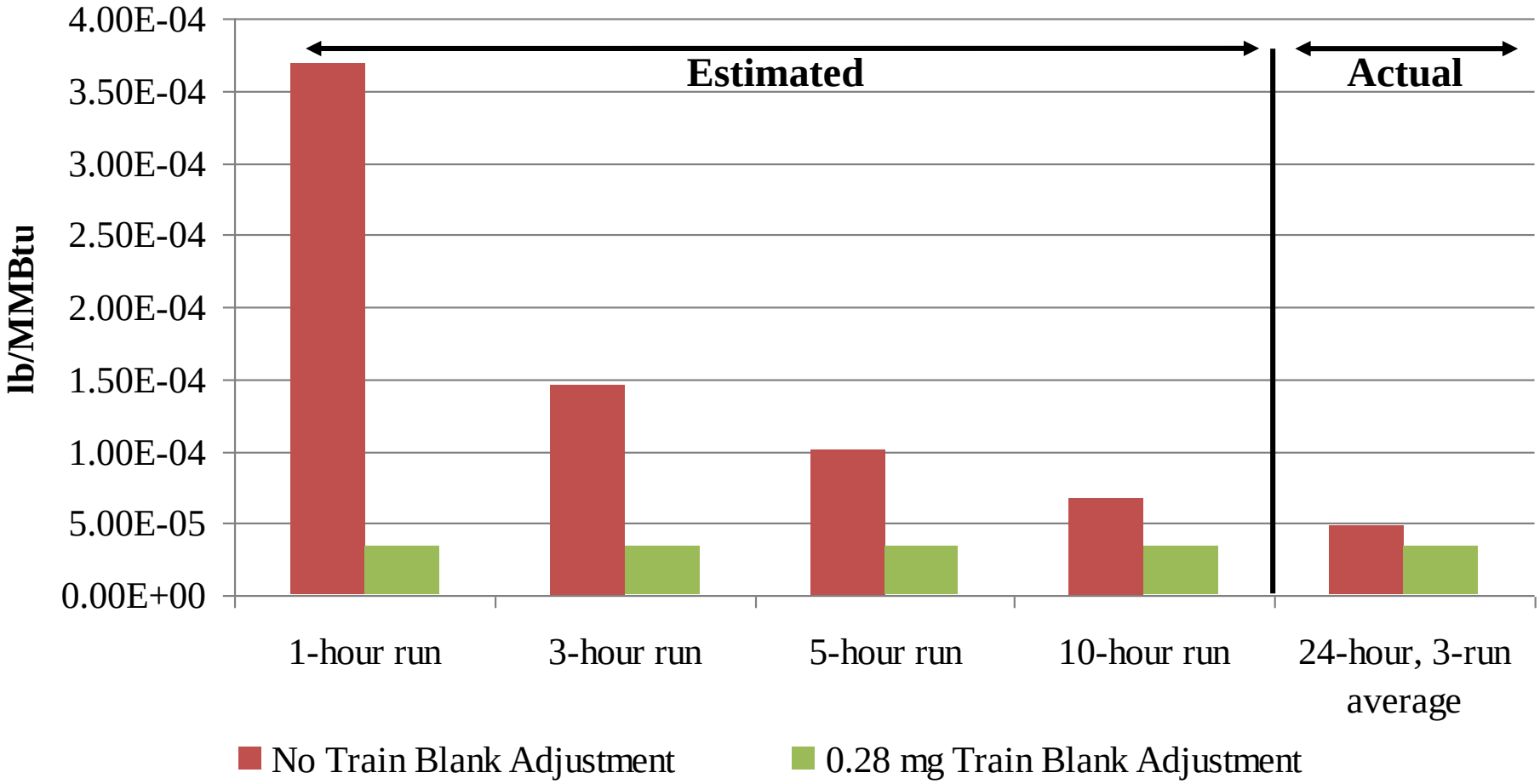
$PM_{2.5}$ Component	Test Method
Filterable $PM_{2.5}$	Method 201A
Condensible PM	Method 202

Filterable $PM_{2.5}$ Emissions from Natural Gas Combustion

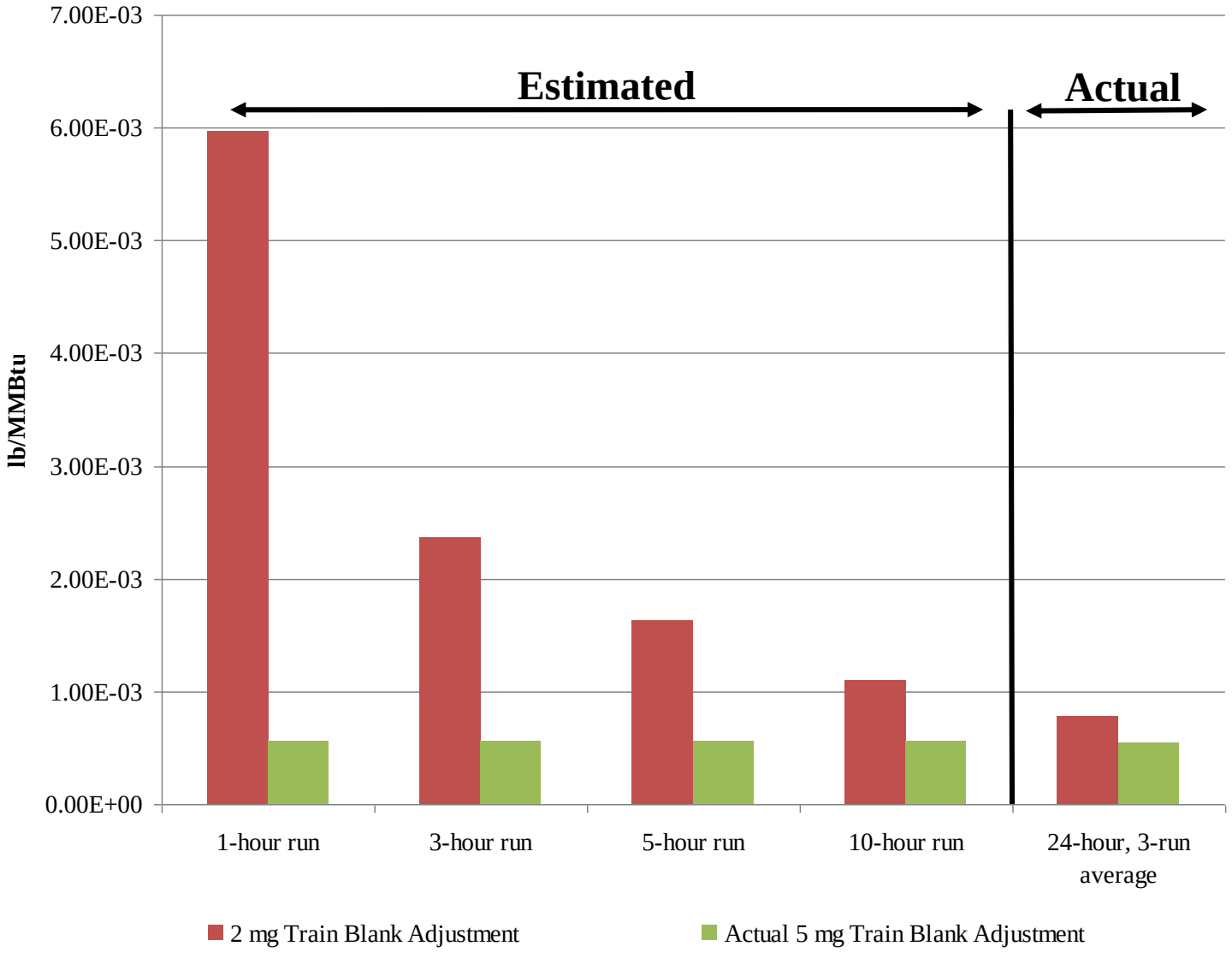
Test Duration: 24 hours

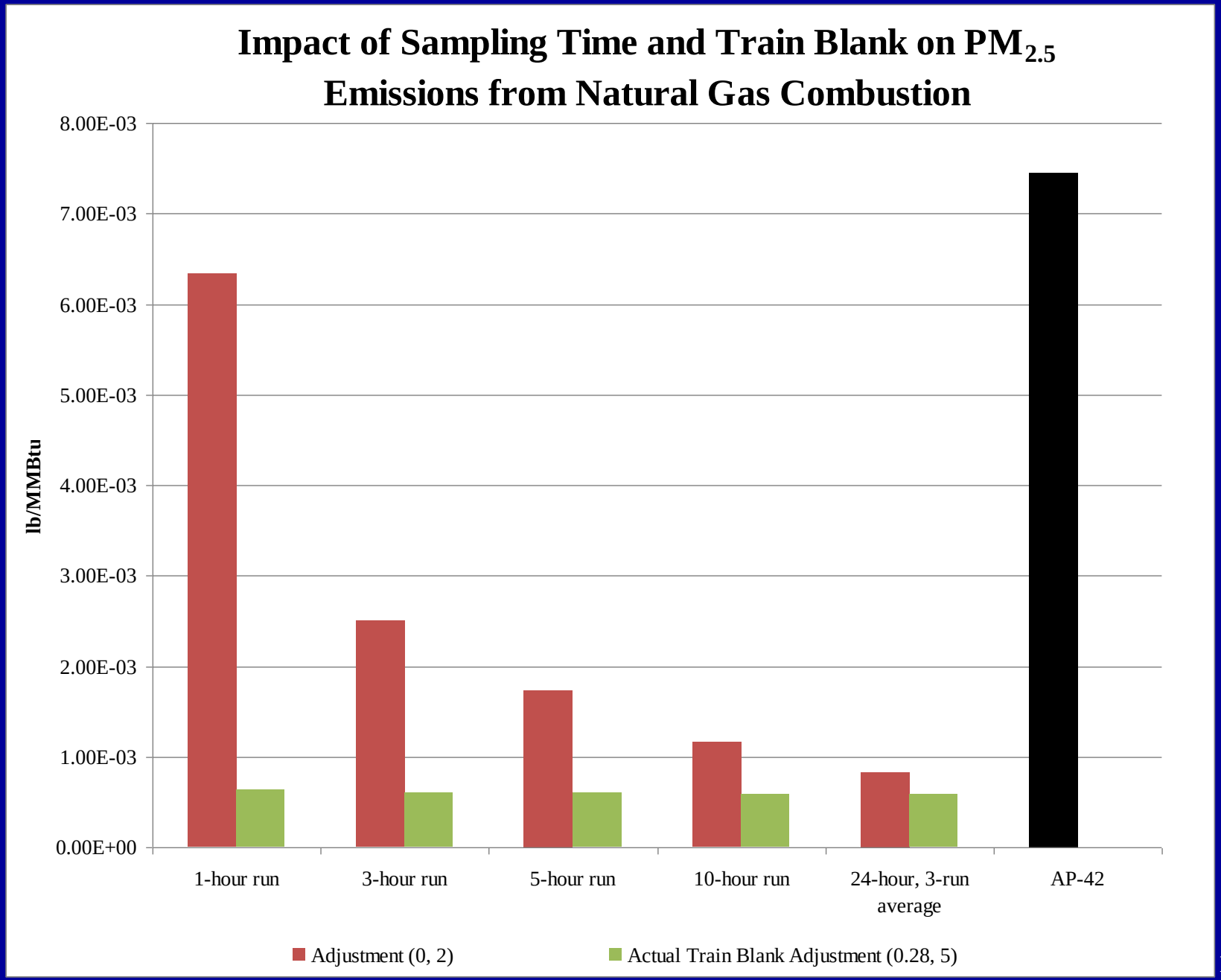
Run No.	$PM_{2.5}$ Mass, mg	NCASI Train Blank, mg
1	1.26	
2	0.85	0.28
3	0.75	
Average	0.95	0.28
True PM Mass, mg = 0.67 mg		

Impact of Sampling Time and Train Blank on Filterable $PM_{2.5}$ Emissions from Natural Gas Combustion



Impact of Sampling Time and Train Blank on CPM Emissions from Natural Gas Combustion



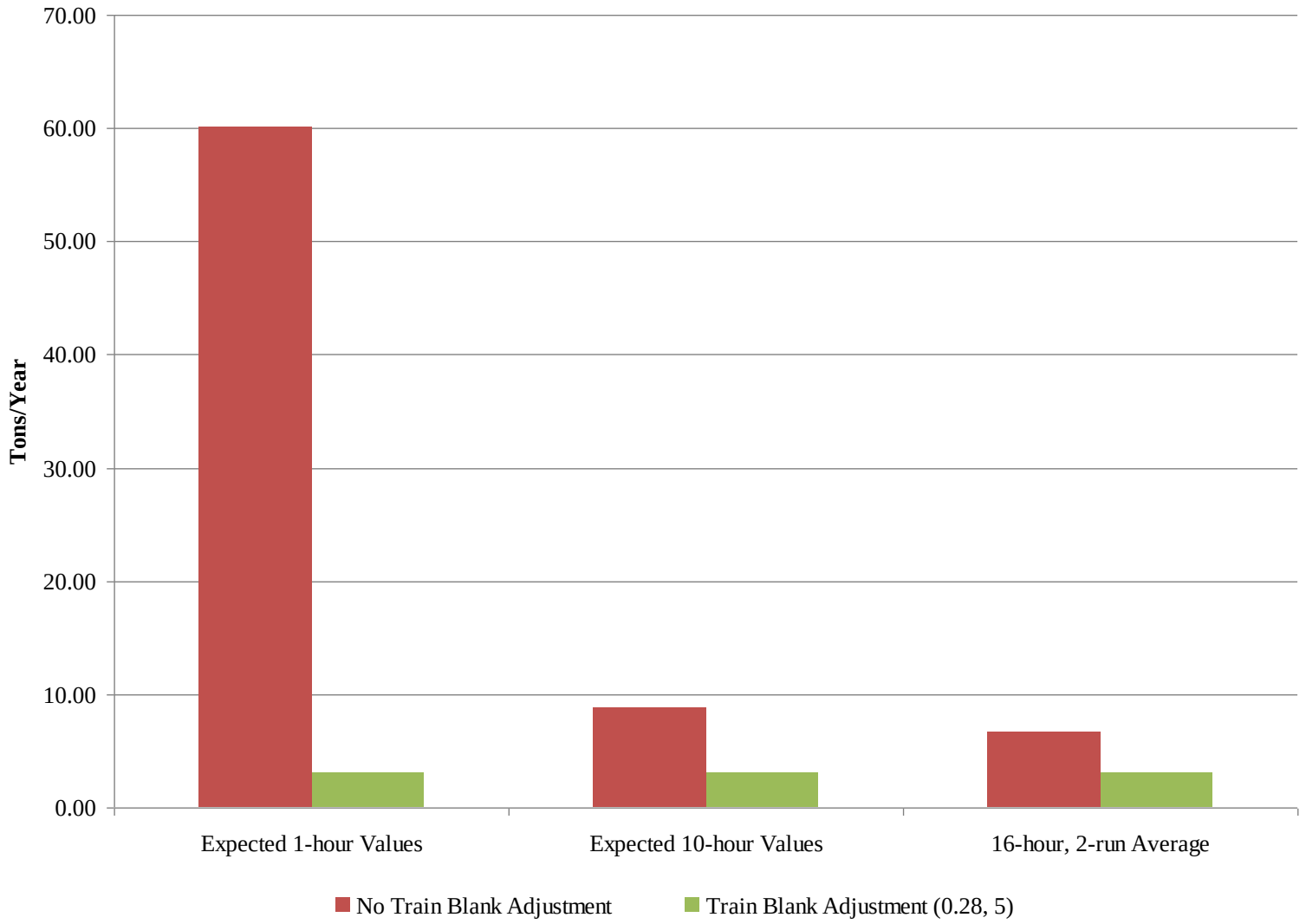

Impact of Sampling Time and Train Blank on PM2.5 Emissions from Natural Gas Combustion
lb/MMBtu
8.00E-03
7.00E-03
6.00E-03
5.00E-03
4.00E-03
3.00E-03
2.00E-03
1.00E-03
0.00E+00
1-hour run
3-hour run
5-hour run
10-hour run
24-hour, 3-run average
AP-42
Adjustment (0, 2)
Actual Train Blank Adjustment (0.28, 5)

Sulfate Content of CPM in Gas-Fired Boilers

Run No.	CPM Mass, mg	$SO_4^=$ Content, mg
1	16.20	8.06
2	12.91	7.72
3	23.94	11.51
Average	**17.68**	**9.10**

Blank corrected CPM = 17.68 – 5.39
= 12.3 mg

Impact of Sampling Time and Train Blank on $PM_{2.5}$ Emissions from a Linerboard Paper Machine



Components of Kraft Recovery Furnace PM and CPM

Analyte	Mass, mg	
	PM	CPM
Carbonate	0.89	22.98
Chloride	13.50	35.68
Nitrate	0.03	0.09
Sulfate	24.07	16.68
Ammonium	0.21	20.25
Potassium	0.40	0.08
Sodium	17.82	0.57
Total Mass by IC (mg)	**57.26**	**96.53**

Impacts of Stack Gas SO_2, NH_3 and HCl on Reported CPM Levels

- Results suggest that CO_2, SO_2, NH_3 and HCl are captured in the CPM train
- Questions being investigated:
  - How much SO_2, NH_3 and HCl are captured in the CPM train?

Overall Impact of $PM_{2.5}$ Measurement Method Issues

- Potential for significant overstatement of emissions due to condensation/capture of gases which do not contribute to atmospheric PM.
- Higher emission rate estimates translate directly into higher modeled emission impacts

Summary

- Pay attention to your inputs
- Otherwise, it is “garbage in, garbage out”

Questions?